Fracture Pressure and Fracture Gradient

Calculated fracture gradient and maximum injection pressure values are given in Table 1.

The Monterey Formation 26R reservoir has been developed with assistance of gas and water injection to maintain reservoir pressure and improve oil recovery efficiency. As part of this process there is Class II UIC approval from CalGEM. The Class II permit approval mandates that the maximum operating pressure gradient should not exceed 0.80 psi/foot unless additional testing indicates a higher gradient is appropriate. With over 40 years of injection that includes 114 million barrels of water and 841 billion cubic feet of gas, there are no recorded incidents of fluid migration out of the Monterey Formation.

Table 1: Summary of the fracture pressure data for the Monterey Formation 26R reservoir at the 373-35R well.

Interval	Breakdown Fracture Gradient PSI/foot	Fracture Pressure (PSI) at base of Reef Ridge Shale (6826.6 feet TVD)
Monterey Formation 26R	1.03	7,031

CTV will ensure that the injection pressure is beneath 90% of the fracture gradient at the base of the Reef Ridge Shale for each injection well using the Monterey Formation 26R breakdown fracture gradient. The planned maximum subsurface wellbore injection gradient for the project is 0.71 PSI per foot. Well 373-35R injection pressure details are shown in Table 2.

Table 2. Injection pressure details.

Injection Pressure Details	**Injection Well 1 373-35R**
Depth corresponding to maximum injection pressure (ft TVD)	6,826.6
Breakdown Fracture gradient (psi/ft)	1.03
Calculated maximum injection pressure at the top of the perforated interval (psi)	7,031
Maximum injection pressure (90% of fracture pressure) (psi)	6,327.9
Elevation at the top of the perforated interval (ft MSL)	-5,484
Planned maximum injection pressure / gradient (top of perforations)	4,900 / 0.71